

## How Early Warning Works

### What is predictive analytics?

Predictive analytics is the use of data patterns to predict future behaviors. An example of this is how Amazon uses items you have searched for or purchased in the past to suggest (or predict) what you might like to purchase in the future. In more mathematical terms, a variety of statistical techniques from modeling, machine learning, and data mining are used to create accurate predictions.

### How does BrightBytes' Early Warning module use predictive analytics?

The Early Warning module makes a prediction about a student's likelihood of dropping out based on past students' actual behaviors. Essentially, Early Warning uses data taken from your student information system (SIS), analyzes the trends (looking at 24 success indicators), and uses the results to select for each grade level a research-based model. Current students are then compared to past students' performance via these models, resulting in the assessment of each student's individual risk level for dropping out.

### How is Early Warning more effective than traditional dropout prevention models?

Traditional early warning systems often use a "checklist" or "flagging" approach. These approaches use research-based indicators to identify students at risk for dropping out but fall short of Early Warning's level of accuracy, early identification, and use of unique district contexts. This is because the threshold approach considers only one factor at a time, whereas the predictive model considers the interaction between and cumulative effect of multiple indicators at once.

- **Greater Accuracy:** Research has shown that EW can identify students at risk of dropping out with over 95% accuracy – as compared to a checklist approach which, depending on the number and type(s) of

indicators used, often range in the area of 60% accuracy or less.

- **Earlier Identification:** Early Warning can identify students showing signs of risk of dropping out as early as 1<sup>st</sup> grade. Most checklist approaches don't kick in until about 9<sup>th</sup> grade. This degree of early identification reflects research that shows students who drop out have a history of disengagement and disassociation from school evident years before a student actually drops out.
- **Customized to the District:** Unlike a checklist approach, which analyzes the same indicators in the same way across districts, Early Warning takes into account your district's unique factors. EW examines students who have dropped out in your district in order to select a model for each grade level that most closely matches historical student trends.

### What are the domains and success indicators used to determine risk-levels?

Early Warning analyzes 24 success indicators that have, when examined in relation to one another, been proven to be most predictive of student dropout risk. EW groups these indicators into four domains to make it easier for you to read and act on your results.

Domain	Success Indicators
Academics	Assessments: District Assessments: State Credits Earned Annually Academic Indicator: All Courses Academic Indicator: Core Academic Courses Grade Retention Pass Rate: All Courses Remedial Courses
Attendance	Attendance: First 30 Days Attendance: Total Tardies
Behaviors	Behaviors: Major Behaviors: Minor Disciplinary Referrals Expulsions Suspensions

Demographics	Age	Ethnicity	Gender	Free/Reduced Lunch
	504 Status	Special Education	(IEP)	Limited English Proficiency
		Mobility		

### How are students' risk levels determined?

- Overall Student Risk: Comparison to historical dropout data determines a student's overall risk level. The student's overall risk level is roughly translated as the student's probability of eventually dropping out. The overall indicator is the single most important piece of student information calculated in the module.

High Risk: Students in this category have a combination of indicators that have historically been associated with dropout. These students are determined to have over 70% risk of dropping out.

Medium Risk: Students who are medium risk have less extreme combinations of warning signs. Still, there is more than a 50% chance that students in this category will drop out.

Low Risk: Students who have a low-risk level have little in common with students who have historically dropped out. Their rate of dropping out is significantly below 50%.

- Overall Domain Risk: Early Warning calculates a student's overall domain risk level using the domain's associated indicators. It is important to note that even if your SIS has data for all 24 indicators, the predictive model will identify which indicators are actually important for your district and use those for calculation. Which indicators are used can vary by grade level or model.
- Success Indicator Risk: To determine a risk level for each indicator, a student's value for that indicator is compared to the high, medium and low risk populations, and the student is assigned the risk level for that

indicator of the subgroup to which his or her indicator value is most similar.

## Interpreting School and District-Level Data

### What does it mean that my school or district is high-risk?

School and district risk levels are based on the number of high-risk students in the organization. If a school is designated high risk, it means that the vast majority of students are exhibiting characteristics that give them better than a 50% chance of eventually dropping out. On average, 78% of students in a high-risk school are at either moderate or high risk of dropping out. A similar formula can be used when examining the number of high-risk schools in a district. Further, this information can be useful for comparing risk levels across schools in a district or districts in a state.

**On the dashboard, some of the success indicators that have yellow or green dots next to them are also listed under warning signs.**

On the dashboard, the dot next to each success indicator shows the predominant risk level in that indicator. For example, if 64% of students are low risk and 36% of students are high risk in tardies, early warning will assign the indicator a green (low risk) dot on the dashboard.

For the warning signs section, early warning ranks the indicators based on how many students in your school, or how many schools in your district, are high risk—regardless of the indicator’s overall risk color—and displays the top three. Going back to the earlier example, if no other indicator had more than 36% high risk, that indicator would be placed at the top of the warning signs section even though the indicator is low risk overall.

**On the district dashboard, I have a success indicator in the “improve analysis” section with the flag “no data for success indicator.” However, I know there is data for the indicator; plus, the indicator has a colored dot next to it on the**

dashboard.

At the district level, improve analysis indicates data quality issues found in the largest number of schools in your district. If you see an indicator appear in improve analysis that also has a colored dot on the dashboard, it means that the indicator is present in some of the district's schools but is missing for a significant number of other schools.

**On the district dashboard, the donut chart has no high-risk schools, but when I look at the individual schools, I see that some have several high-risk students. Shouldn't these schools be listed as high risk?**

On the district dashboard, the donut shows the breakdown of schools by risk level. Early warning determines a school's risk level based on its percentage of high, moderate, and low risk students. It's very possible to have low-risk schools that still have high-risk students; in this event, the school will appear to the district as low risk, but those students will be emphasized on the school's dashboard as high risk. If you visit the school's dashboard, the donut will show the exact student breakdown by risk level.

## Calculating Student Risk

**What date range is used to collect student data?**

The risk levels for current students are based upon the most recent 12 months of data available for that student. This is regularly updated as more recent data becomes available. For example, when the first 30 days of attendance becomes available for a given school year this will automatically be updated displayed in the dashboard. The risk prediction models, however, are based on multiple years of historic student data.

**Why does EW assign a color rather than a percentage to identify a student's risk?**

Early Warning calculates probability of dropping out. Because a singular probability cannot capture the complexity of a student's performance, EW uses probability behind the scenes to calculate a student's risk level but displays results in a scale of 10 colors. Colors range from dark red (highest risk) to light green (lowest risk) and grey (not enough data to predict), so schools can make deliberate decisions about grouping and intervention. The color system also takes into consideration a certain margin of error, in effect, creating a more accurate determination of risk-level than a precise numerical calculation. Using risk-level colors leaves the math up to the complex algorithm rather than leaving thresholds and grouping to the determination of busy educators.

### **When are the graduation rates from?**

The graduation rates are the cohort graduation rates from 2012-13. These rates are used because the auditing and review process for the 2013-14 rates has not been completed.

### **On a student's profile page, the student only has a few success indicators with red dots (or none at all), but the student is rated as high-risk overall.**

There are two main reasons why a student could be high risk overall yet have few or no high-risk success indicators (red dots). First, having a significant number of moderate (yellow dot) risk indicators can contribute to an overall high-risk prediction, even if no individual indicator is high risk. Second, demographics play a role in the overall prediction, especially in the younger grades, and if the student is high risk in certain areas (such as qualifying for free & reduced lunch), it can move him or her into the high-risk category.

### **Why should elementary educators be concerned with risk-levels when graduation is years away?**

It is important to remember that a student's risk factors develop gradually over time and that trends can emerge as early as 1<sup>st</sup> grade. Principals at the elementary level have the greatest opportunity to effect change in high-risk

students and get them back on track to graduate long before they drop out.

**I have a student who has risk levels for some of his or her success indicators but an overall risk of unavailable.**

This occurs when there are too few data points to create an overall prediction for a student. However, early warning will categorize by risk level all available success indicators, adding new indicators and updating existing ones as new data becomes available, and will assign an overall prediction as soon as possible.

**I see a green (low risk) dot next to grade retention for a student, but I know the student was retained several years ago.**

The grade retention marker indicates whether a student has been retained in your district within the last year. Therefore, if a student was retained earlier in his or her career, it will not affect the color of this indicator. However, early warning also takes age into account, so if the student is unusually old for his or her grade, this factor will impact the overall prediction.

**There's a student who only had one suspension, but the suspension indicator is red.**

A single suspension, especially at the elementary grade levels, can be a strong predictor of a student's likelihood to drop out.